D R A F T

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PIER 30/32 INTERIM STORMWATER MANAGEMENT APPROACH

December 23, 2011

Prepared for:
San Francisco Regional Water Quality Control Board
San Francisco Bay Region
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Contents

Purpose

This document presents a practicability analysis and maintenance program for stormwater management at Pier 30/32. It explores 4 options to install interim post construction best management practices (BMPs) to address stormwater runoff associated with interim use of Pier 30/32 as a parking lot.

Current Conditions

The existing pier is 600 feet wide and 900 feet long, and comprises approximately 550,000 square feet (SF) of area, and was built in stages in 1912, 1926 and 1956. The surface of the pier consists of a concrete deck covered with between 2 and 12 inches of asphalt concrete. Major features include the central depressed area and major depressions (approximately 6-8 inches deep) running the length of the pier at the mid-point of both Pier 30 and Pier 32.

The pier currently has a finished elevation that ranges by over 18 inches throughout the site. Stormwater contacting the pier runs via sheet flow or through small thru-deck drains directly to the Bay without treatment. The existing pier has thru-deck drains that route stormwater from the surface to the Bay below. No storm drain system is in-place that connects to the combined storm system, however 11,000 SF of over land deck sheet flows to the combined system. The "infill" area is a pile supported structural deck that connects Pier 30 to Pier 32. The in-fill area is depressed in elevation between the adjacent Pier 30 and Pier 32 grades.

Table 1. Existing Conditions

Area Type	Current Stormwater Drainage	Land Use	Treated	Not Treated	Area (SF)	Area (AC)	Percentage
Lower Deck (infill area)	Sheet flow to Bay	Parking		X	93,000	2.13	17%
Upper Deck (piers 30 & 32)	Sheet flow to Bay or thru deck drains to Bay	Parking		X	450,600	10.34	81%
On Land	Sheet flow to the combined sewer system	Parking	X		11,000	0.25	2%
TOTAL					**554,600**	**12.7**	**100%**

Phasing

Construction: In accordance with the Construction General Stormwater Permit, the project sponsor will prepare and implement a SWPPP to minimize construction water quality impacts. The SWPPP would identify pollutant sources within the construction area and recommend site-specific BMPs to prevent discharge of pollutants into stormwater. The project intends to file one notice of intent (NOI) for compliance with the Construction General Stormwater Permit which would encompass each individual construction sites including Pier 80, Piers 30/32, Piers 27/29, and Marina Green.

AC34: The team bases that will be constructed at Piers 30/32 will involve boat maintenance activities and the use of hazardous materials that could be sources of stormwater pollutants. Boat maintenance activities, the outside storage of heavy equipment (e.g., cranes), and the use of hazardous materials associated with the team base activities could be potential sources of stormwater pollutants. Typically, tenants on Port property are responsible for securing their own coverage under the Industrial Storm Water General Permit based on the type of industrial activity present on site.

Boat maintenance activities, the outside storage of heavy equipment (e.g., cranes), and the use of hazardous materials associated with the team base activities will be addressed with an Industrial SWPPP which must identify sources of pollutants and the means to manage these sources to reduce stormwater pollution. The project sponsor will file one NOI for compliance with the Industrial General Stormwater Permit which would cover the team base activities at both Pier 80 and Piers 30/32.

A monitoring plan will also be required under the Industrial permit which will require the sampling of storm water runoff during a minimum of two storm events each rainy season. Samples will analyzed for pH, Total Suspended Solids, Specific Conductance, and Oil &Grease or Total Organic Compounds. The requirements of the Industrial Permit will be includes in the Team Base Operations Plan.

Post-AC34:

As part of the Host Agreement, long term development rights have been granted for Pier 30/32. It is expected that the long term development project would be a mixed use commercial/residential project and will include substantial open space creating an excellent opportunity for stormwater controls and reuse demand. This long term development would be subject to the requirements of the San Francisco Stormwater Management Ordinance (SMO) and Stormwater Design Guidelines (SDG) including post-construction controls meeting MEP. The long-term development BMPs would replace any interim BMPs.

AC34 Project Description

Pier 30/32 will need deck replacement, existing pile rehabilitation and new pile installation work to support the AC34. The infill area will be raised to adjacent grade by a new structural slab constructed on beams. The existing deck surface will remain in-place and structural elements will reside on that surface to support the new structural slab. New piles will be installed to support the new deck load. The areas requiring improvement are shown on Exhibit 1.

Table 2. Summary of Improvements

Description	Area (SF)	Area (AC)	Percentage
Raise Depressed Area	92,938	2.13	17%
Other Structural Work	102,299	2.35	19%
SUBTOTAL	**195,237**	**4.48**	**35%**
No Improvements	359,363	8.25	65%
TOTAL	**554,600**	**12.7**	**100%**

<u>Overview Constraints and Opportunities</u>

General Site Constraints

- No soil, can not infiltrate
- Load bearing/seismic constraints
- Can not site anything around edge of pier due to boating/fishing/public access, or extend out from pier due to shading, bay infill issues
- Issues regarding historic resources limiting above ground structure that can be installed on historic piers

Pollutants of Concern associated with Interim Parking Lot Use

- Sediment
- Oils/Grease
- Metals
- Trash

Site Opportunities

- Infill Area—the new deck can be graded in any direction, as long as the maximum slope is 1% or less (to not interfere with activities at the team bases). There is additional flexibility in construction as the new supports can be modified to accommodate stormwater BMPs.
- Central Depressions—As shown on Exhibit 1, there are two existing “valleys”, one each running down the center of the original Piers 30 and 32. Stormwater BMPs can be placed along the valley and not require significant re-grading.

BMP Selection

The BMP selection process consists of two steps: determining which BMPs fit best on the site given the site conditions and site plan, and selecting those BMPs best suited to treat the pollutants of concern. Based on the general site constraints listed above, and after extensive public outreach and consultation with the Regional Water Quality Control Board, the SDG recommends 7 BMPs suited for use on a pier over water:

1. Rain Gardens (Bioretention)
2. Cistern for Rainwater Harvesting
3. Detention Pond
4. Vegetated Pontoons
5. Above Ground Planter for Biofiltration
6. Trench Drains for Conveyance
7. Vortex/Swirl Separator or Media Filter

Matching the site constraints/opportunities:

1. Rain Garden	Merits further consideration/combine in concept with #5
2. Cistern	Eliminated for further study because there is no interim demand for reuse and there are seismic/structural issues with storing water
3. Detention	Eliminated for further study because there are seismic/structural issues with storing water
4. Vegetated Pontoon	Eliminated for further study because there are public access issues with limiting public access to the edges of the pier
5. Biofiltration Planter	Merits further consideration/combine in concept with #1
6. Trench Drain	Eliminated for further study because it is preferable to use existing drainage patterns than construct additional temporary utilities
7. Vortex/Swirl Separator or Media Filter	Merits further consideration

Description of BMPs Selected

Based the proposed site plan, the pollutants of concern, and taking advantage of the existing drainage patterns without additional utilities (e.g., pipes or pumps) the BMPs worth further consideration are at grade bioretention planters (designed to function similar to the combination of a lined rain garden and biofiltration planter) and media filters.

The planters will be designed to accept sheet flow and not require any pumping or under pier piping. They will be designed to incorporate a forebay providing pre-treatment for sediment and trash. This pretreatment will also reduce the maintenance burden by reducing the area requiring trash pickup, and lengthening the time between replacement of the main planter media. With pre-treatment, the bioretention planters can be expected to treat sediment, trash, metals, and oil and grease.

The planters may or may not be design to include vegetation or if vegetation is included it may be limited in height to address CEQA concerns for maintaining the Historic character of the pier. The bioretention planter will need to be consistent with the Port's historic resources plans and policies, the surrounding Embarcadero Historic District and the restrictions identified in the AC 34 CEQA document.

The at-grade planter will not include a high flow bypass and will therefore treat a greater volume of flow over a longer period of time than a typical above ground planter. In larger storms, flow will be allowed to pond before entering the planter. The maximum depth of ponding will be approximately 0.7 feet. The maximum time ponded is expected to be approximately 22 hours, and could result in a loss of available parking spaces. Because of the extended treatment time, the maintenance schedule has been adjusted to reflect a higher frequency of cleanout of the organic compost and more frequent inspection and clearing of the pretreatment areas compared with a typical above ground planter.

Sizing calculations for the bioretention planter are included as Appendix 1. A typical cross section and planter details are shown on Exhibit 6.

Media filters were selected over vortex swirl separators and the filter insert basins as originally proposed because they meet MEP. The media filters will be equipped with a media cartridge designed to treat oil and grease pollution accompanied by sediment, trash and debris. This technology is an upgrade from the original filter inserts proposed, and will provide a greater level of treatment with less risk of failure. Specifications for the media filter are included as Exhibit 7.

Drainage Concepts

Alternative 1.

The first post-construction stormwater management approach evaluated here is shown on Exhibit 2. The interior portion of the pier would be sloped to sheet flow into an at grade bioretention planter installed in the new infill area. Additional planters would be placed in the valleys central to the existing piers 30 and 32. The weight of the planters would require construction of three additional piles beneath the pier.

Table 3. Interim Approach Alternative 1

Stormwater Treatment	Land Use	Treated	Not Treated	Area (SF)	Area (AC)	Percentage
Bioretention Planter	Parking	X		348,990	8.0	63%
Media Filters	Parking	X		102,420	2.4	18%
Sheet Flow to Bay	Parking		X	92,070	2.1	17%
Sheet Flow to Combined Sewer	Parking	X		11,120	0.3	2%
TOTAL				**554,600**	**12.7**	**100%**

Alternative 2.

The second post-construction stormwater management approach evaluated here is shown on Exhibit 3. The interior portion of the pier would be sloped to sheet flow into an at grade bioretention planter installed in the new infill area. All of the additional area would be upgraded to include the installation of media filters at the existing unfiltered drain inlets. No new piles would be required under this approach.

Table 4. Interim Approach Alternative 2

Stormwater Treatment	Land Use	Treated	Not Treated	Area (SF)	Area (AC)	Percentage
Bioretention Planter	Parking	X		199,130	4.6	36%
Media Filters	Parking	X		252,280	5.8	45%
Sheet Flow to Bay	Parking		X	92,070	2.1	17%
Sheet Flow to Combined Sewer	Parking	X		11,120	0.3	2%
TOTAL				**554,600**	**12.7**	**100%**

Alternative 3.

The third post-construction stormwater management approach evaluated here is shown on Exhibit 4. All of the pier 30/32 area would be upgraded to include the installation of 28 media filters at the existing unfiltered drain inlets. No new piles would be required under this approach.

Table 5. Interim Approach Alternative 3

Stormwater Treatment	Land Use	Treated	Not Treated	Area (SF)	Area (AC)	Percentage
Media Filters	Parking	X		451410	10.4	81%
Sheet Flow to Bay	Parking		X	92,070	2.1	17%
Sheet Flow to Combined Sewer	Parking	X		11,120	0.3	2%
TOTAL				**554,600**	**12.7**	**100%**

Alternative 4.

The fourth post-construction stormwater management approach evaluated here, and shown on Exhibit 5, is identical to Alternative 2 but without the installation of the media filters.

Table 6. Interim Approach Alternative 4

Stormwater Treatment	Land Use	Treated	Not Treated	Area (SF)	Area (AC)	Percentage
Bioretention Planter	Parking	X		199,130	4.57	36%
Sheet Flow to Bay	Parking		X	344,350	7.91	62%
Sheet Flow to Combined Sewer	Parking	X		11,120	0.26	2%
TOTAL				**554,600**	**12.7**	**100%**

Cost/Feasibility Analysis

Table 6 summarizes the cost and feasibility of each option. Detailed cost estimates are included in Appendix 2. The total area treated in each alternative is compared by cost in Table7.

Table 6. Cost/Feasibility Summary

	Cost Estimate	Feasibility
Alternative 1		
1@ 3,000 SF planter--Infill area	$929,000	Total cost is high. Requires three additional piles to support the weight of the bioretention planters. Construction of additional piles could trigger revision of existing permits or new permits.
4@ 487.5 SF planters--Pier 30	$1,330,000	
4@ 487.5 SF planters--Pier 32	$1,330,000	
3@new support piles	$750,000	
5@ media filters	$25,000	
TOTAL COST	**$4,364,000**	
Alternative 2		
1@ 3,000 SF planter--Infill area	$929,000	Total cost is median. Requires no additional piles. Treats a larger area than required.
17@ media filters	$85,000	
TOTAL COST	**$1,014,000**	
Alternative 3		
28 @ media filters	**$139,000**	Total cost is low. Requires no additional piles. Does not meet MEP.
Alternative 4		
1@ 3,000 SF planter--Infill area	**$929,000**	Total cost is low. Requires no additional piles. Meets MEP.

Table 7. Cost by Area Treated (in SF)

	Bioretention Planter	Media Filter Catch Basin	Combined Sewer	Total Area Treated	Cost Estimate	Cost per SF Treated
Alternative 1	348,990	102,420	11,120	462,530	$ 4,364,000	$ 9.44
Alternative 2	199,130	252,280	11,120	462,530	$ 1,014,000	$ 2.19
Alternative 3	0	451,410	11,120	462,530	$ 139,000	$ 0.30
Alternative 4	199,130	0	11,120	210,250	$ 929,000	$ 4.42

All of the alternatives treat the required area of 195,237 SF. The additional area treated can be applied as an offset to the areas requiring treatment on other AC34 sites.

Alternative 1 is not feasible due to the need for additional seismic piles. In addition to the high cost, this would require additional permitting and cause additional environmental impacts. Of the remaining alternatives, Alternative 3 is the least expensive but provides no vegetation or habitat. Alternative 2 is therefore the preferred alternative.

Maintenance Overview

A detailed operations and maintenance plan will be included in the Stormwater Control Plan. See attached plan for an overview of the schedule and description of the components that will be included in the maintenance plan.

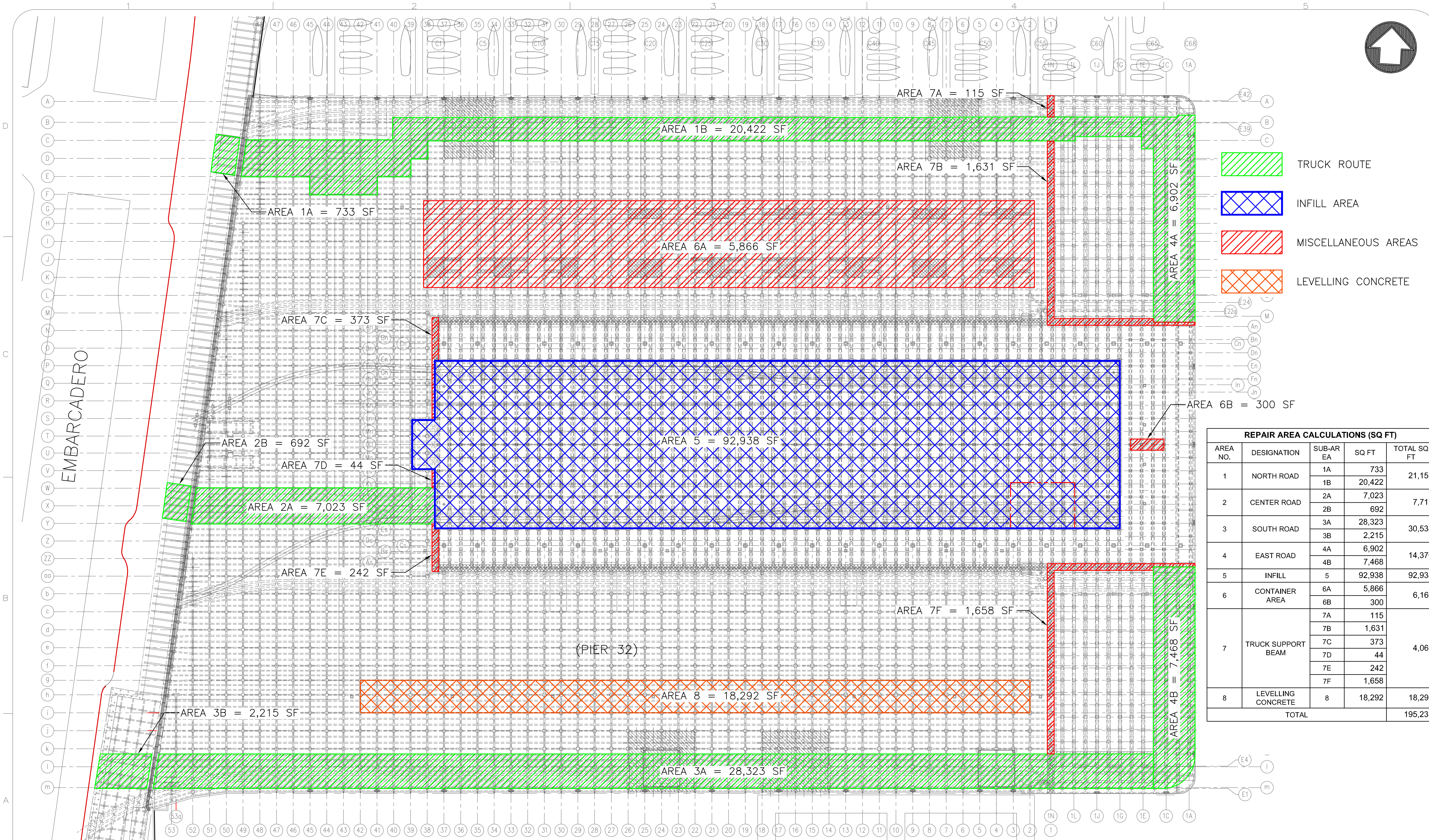
ATTACHMENTS

EXHIBIT 1	Areas of Improvements
EXHIBIT 2	Future Site Drainage—Alternative 1
EXHIBIT 3	Future Site Drainage--Alternative 2
EXHIBIT 4	Future Site Drainage--Alternative 3
EXHIBIT 5	Future Site Drainage--Alternative 4
EXHIBIT 6	Bioretention Planter--Cross Section and Details
EXHIBIT 7	Media Filter Specifications

APPENDIX 1	Bioretention Sizing Calculations
APPENDIX 2	Detailed Cost Estimates

EXHIBIT 1

Areas of Improvements



REPAIR AREA CALCULATIONS (SQ FT)

AREA NO.	DESIGNATION	SUB-AREA	SQ FT	TOTAL SQ FT
1	NORTH ROAD	1A	733	21,155
		1B	20,422	
2	CENTER ROAD	2A	7,023	7,715
		2B	692	
3	SOUTH ROAD	3A	28,323	30,538
		3B	2,215	
4	EAST ROAD	4A	6,902	14,370
		4B	7,468	
5	INFILL	5	92,938	92,938
6	CONTAINER AREA	6A	5,866	6,166
		6B	300	
7	TRUCK SUPPORT BEAM	7A	115	4,063
		7B	1,631	
		7C	373	
		7D	44	
		7E	242	
		7F	1,658	
8	LEVELLING CONCRETE	8	18,292	18,292
	TOTAL			195,237

PERMIT SUBMITTAL

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REV.	DATE	DESCRIPTION	BY / SUB.	APP.
A	09/20/11	PERMIT SUBMITTAL		

DESIGNED BY: MH
DRAWN BY: LD/LV
CHECKED BY: X. TANG
APPROVED BY: B. ERICKSON
SUBMITTAL DATE: 09/20/11

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PIER 30–32 IMPROVEMENTS

PIER STRENGTHENING

REPAIR AREAS AND SQUARE FOOTAGE

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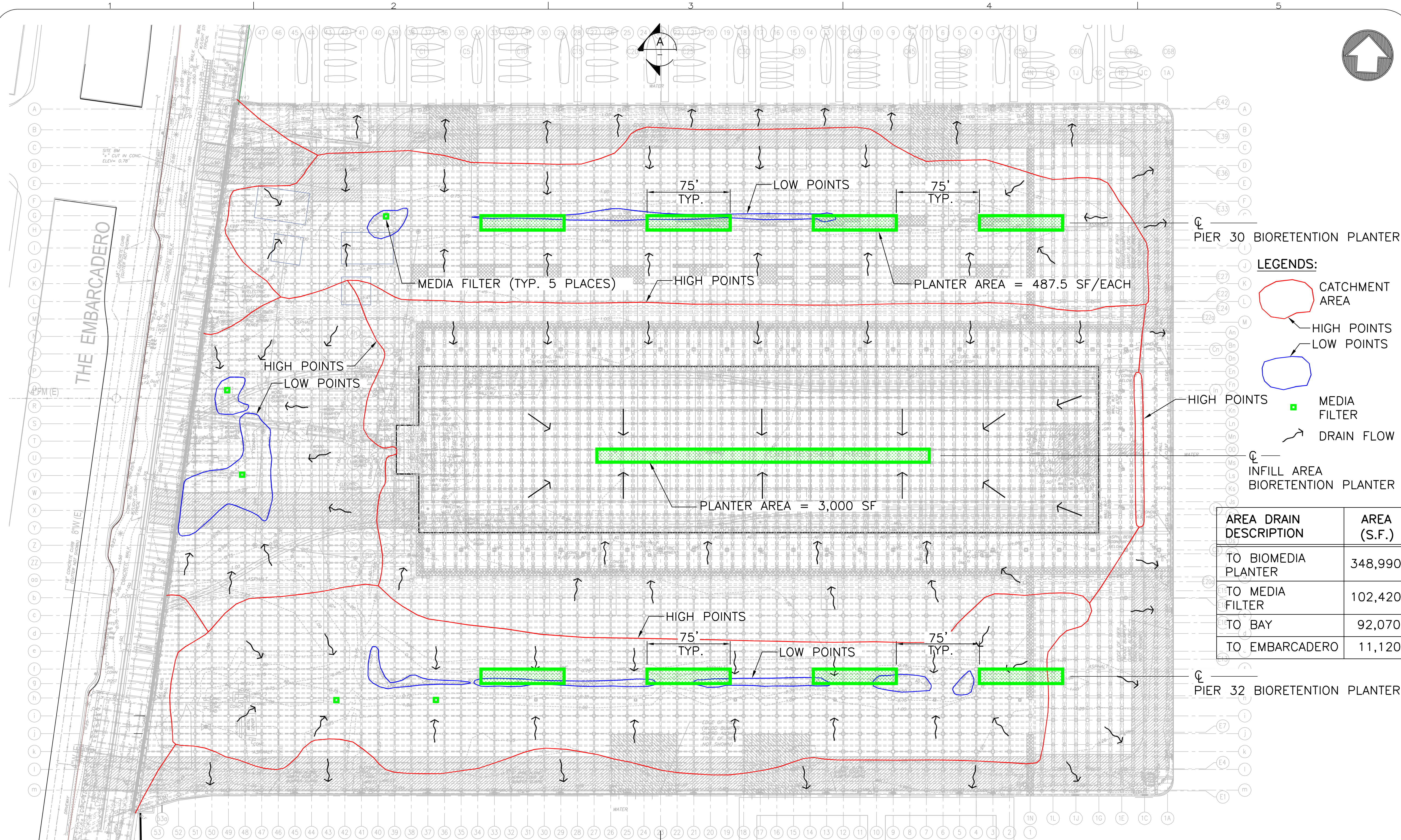
EXHIBIT 2

Future Site Drainage—Alternative 1



AREA DRAIN DESCRIPTION	AREA (S.F.)
TO BIOMEDIA PLANTER	348,990
TO MEDIA FILTER	102,420
TO BAY	92,070
TO EMBARCADERO	11,120

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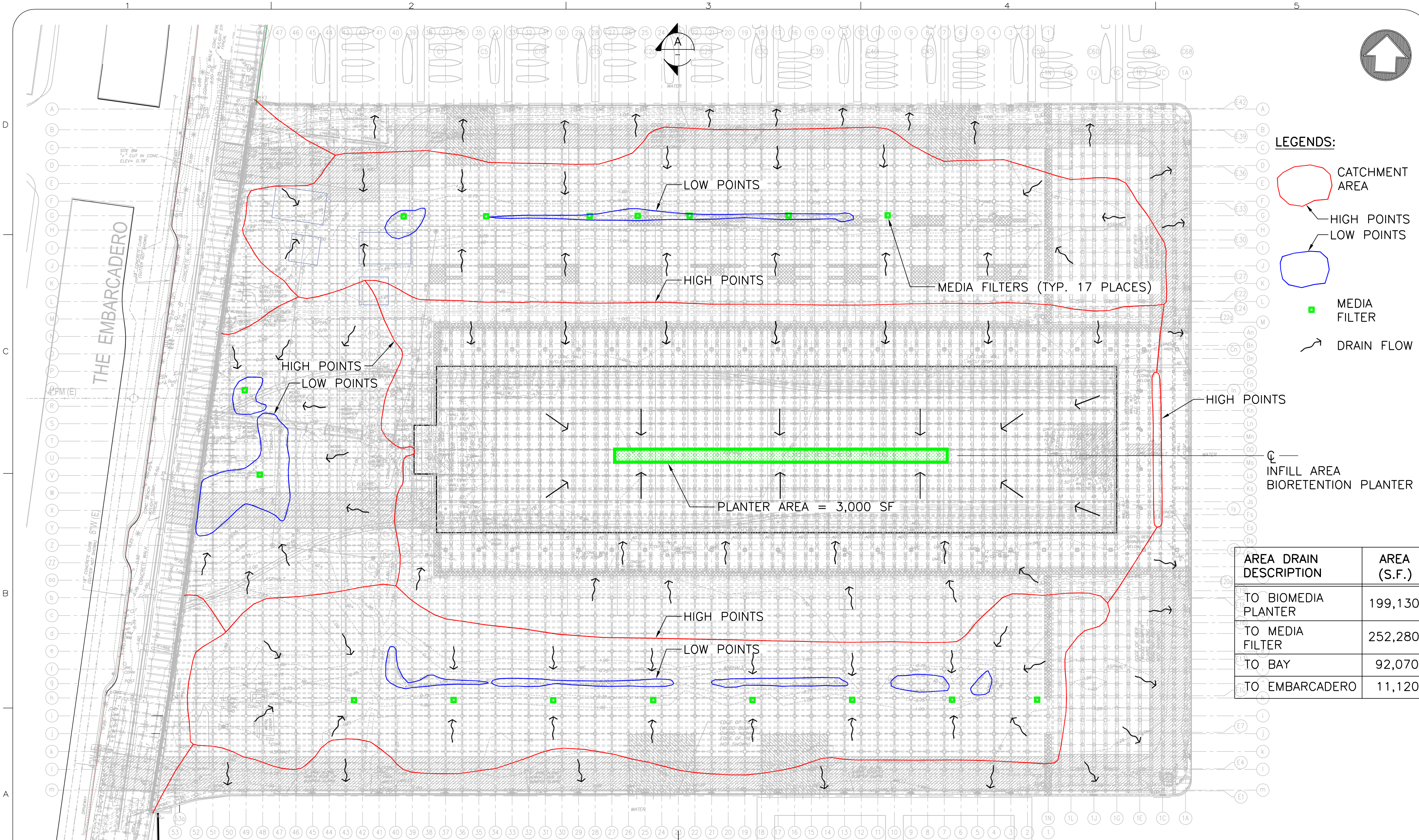
SCALE

EXHIBIT 3

Future Site Drainage--Alternative 2



LEGENDS:

- CATCHMENT AREA
- HIGH POINTS
- LOW POINTS
- MEDIA FILTER
- DRAIN FLOW

AREA DRAIN DESCRIPTION	AREA (S.F.)
TO BIOMEDIA PLANTER	199,130
TO MEDIA FILTER	252,280
TO BAY	92,070
TO EMBARCADERO	11,120

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BIORETENTION PLANTERS
ALTERNATIVE 2

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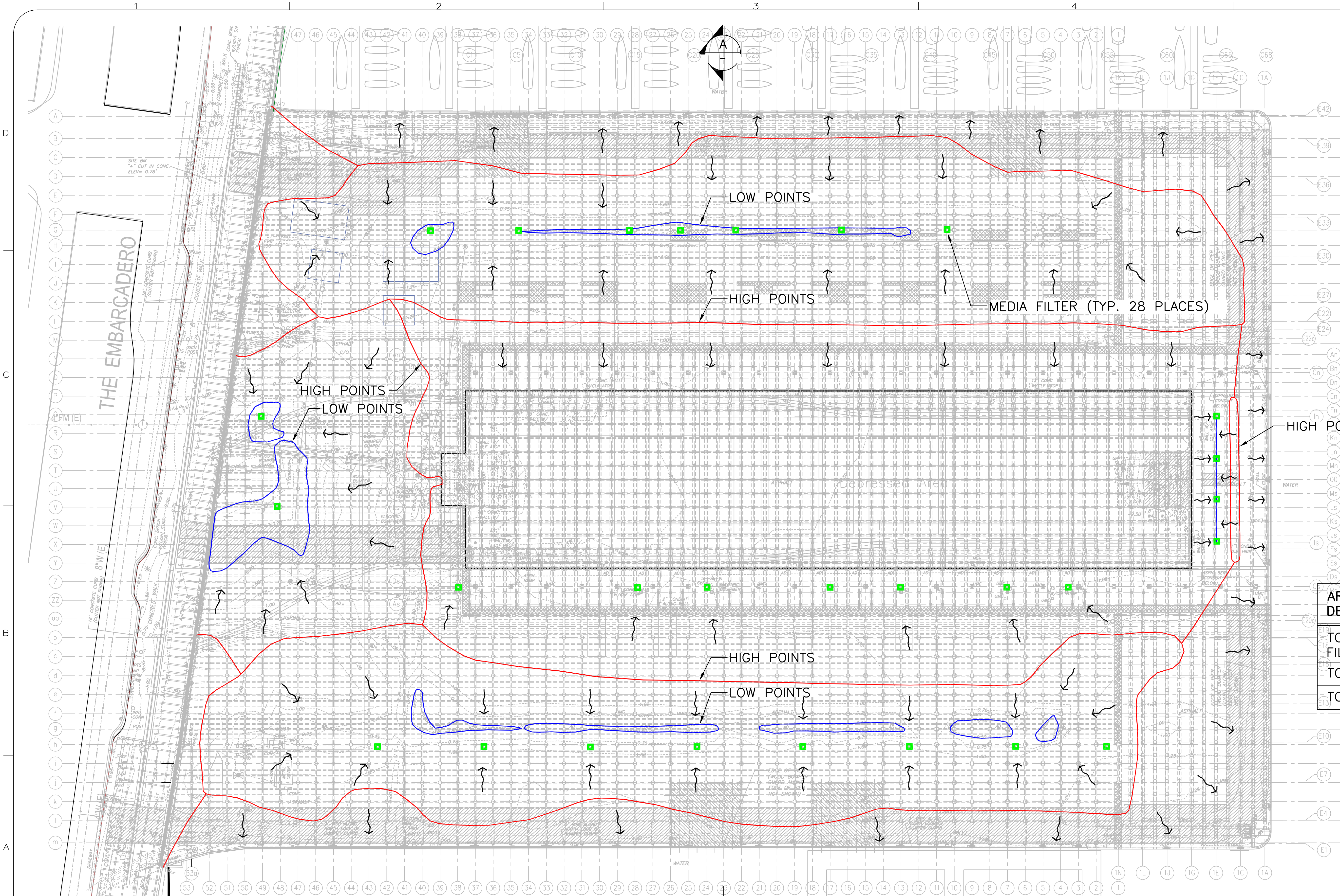
SCALE

EXHIBIT 4

Future Site Drainage--Alternative 3



LEGENDS:

- CATCHMENT AREA
- HIGH POINTS
- LOW POINTS
- MEDIA FILTER
- DRAIN FLOW

AREA DRAIN DESCRIPTION	AREA (S.F.)
TO MEDIA FILTER	451,410
TO BAY	92,070
TO EMBARCADERO	11,120

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ALTERNATIVE 3

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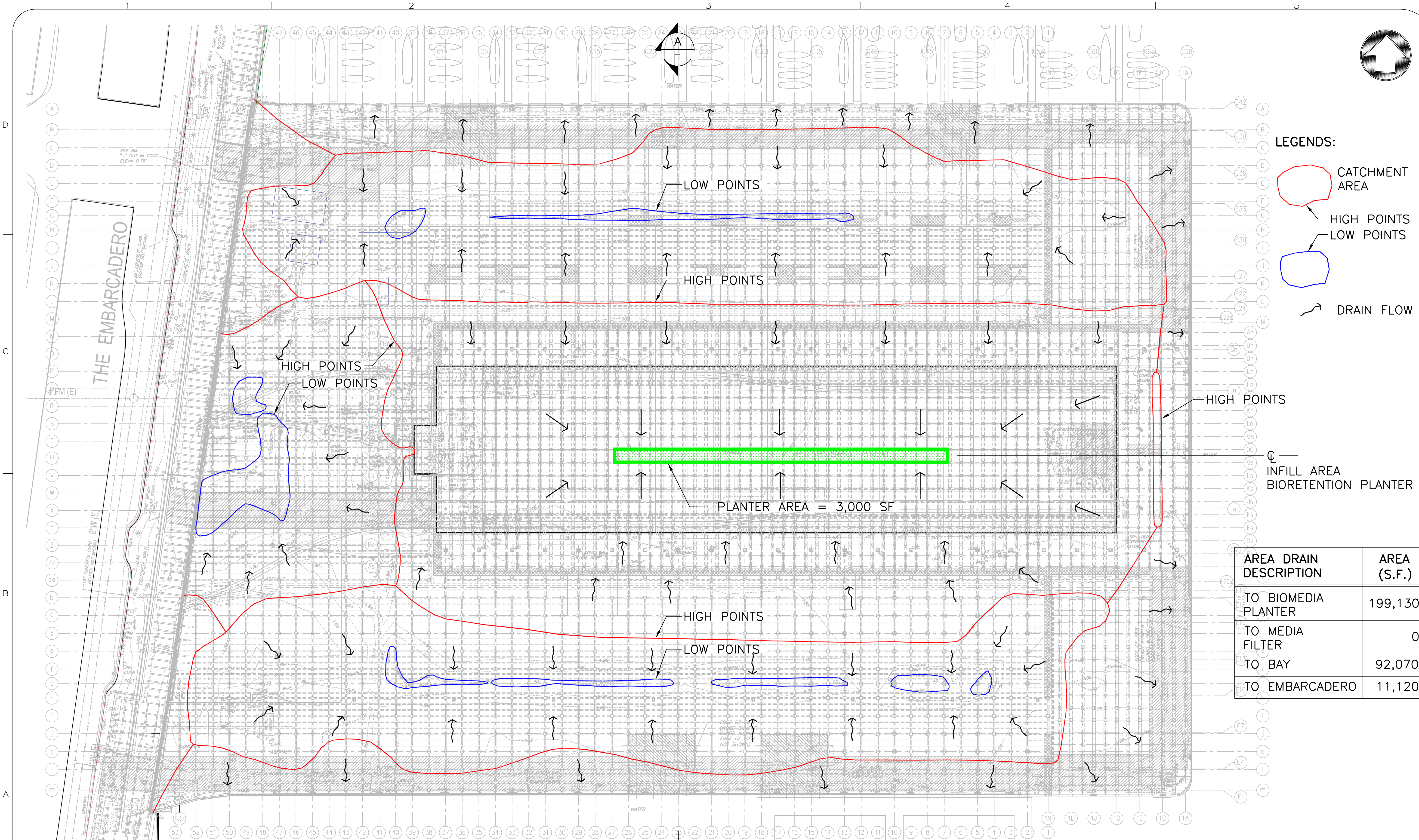
EXHIBIT 5

Future Site Drainage--Alternative 4



AREA DRAIN DESCRIPTION	AREA (S.F.)
TO BIOMEDIA PLANTER	199,130
TO MEDIA FILTER	0
TO BAY	92,070
TO EMBARCADERO	11,120

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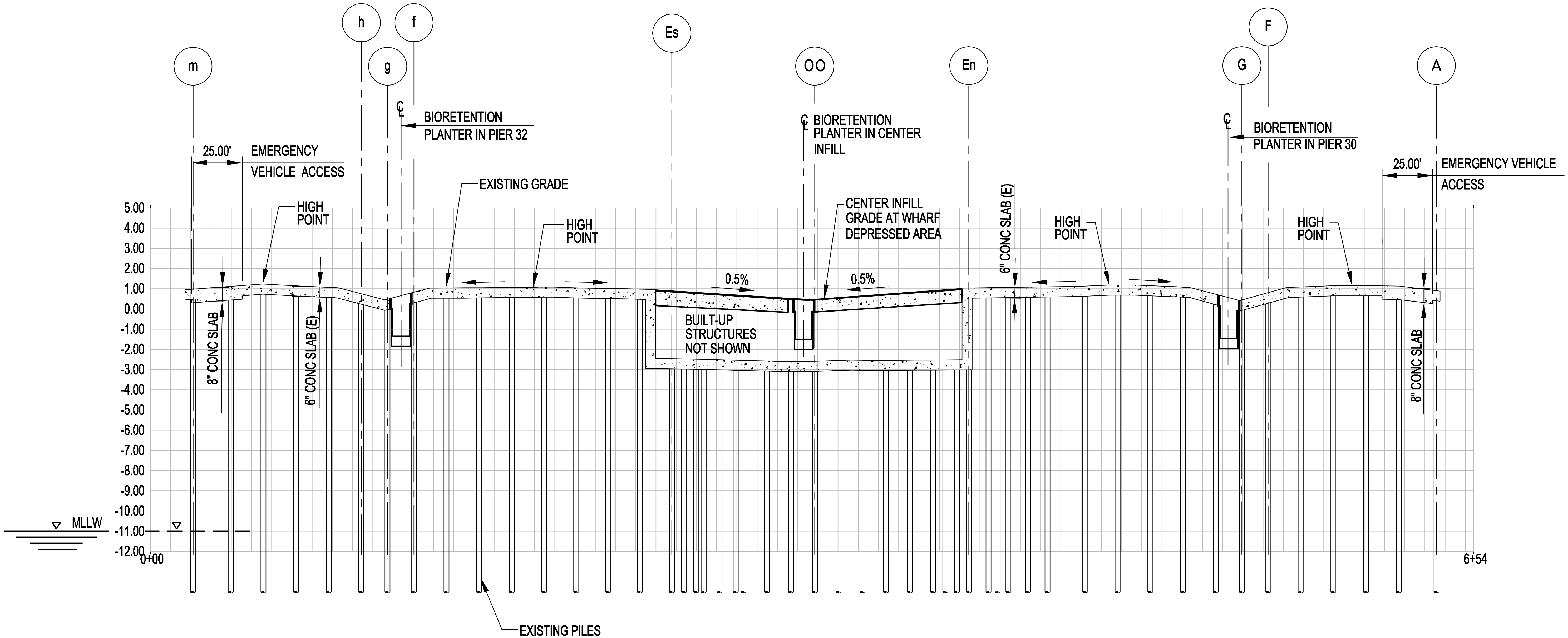
EXHIBIT 6

Bioretention Planter--Cross Section and Details



SECTION A/-
THRU PIERS AT GRID LINE 23 LOOKING WEST

50' 0' 50' 100'
SCALE: 1"=50' HORIZ.(HALF SIZE)
1"=5' VERT.(HALF SIZE)

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DRAWN BY: E. MEEKS
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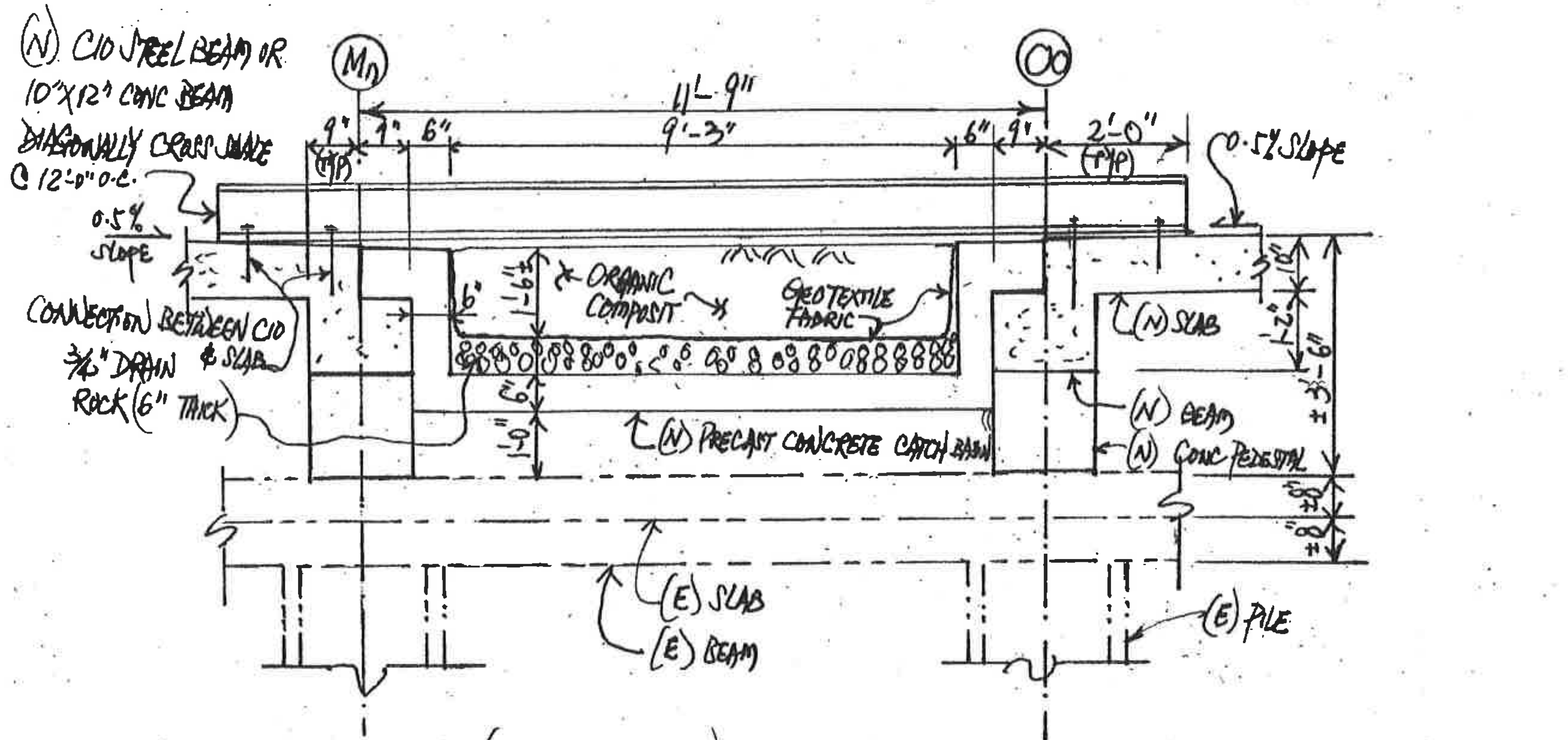
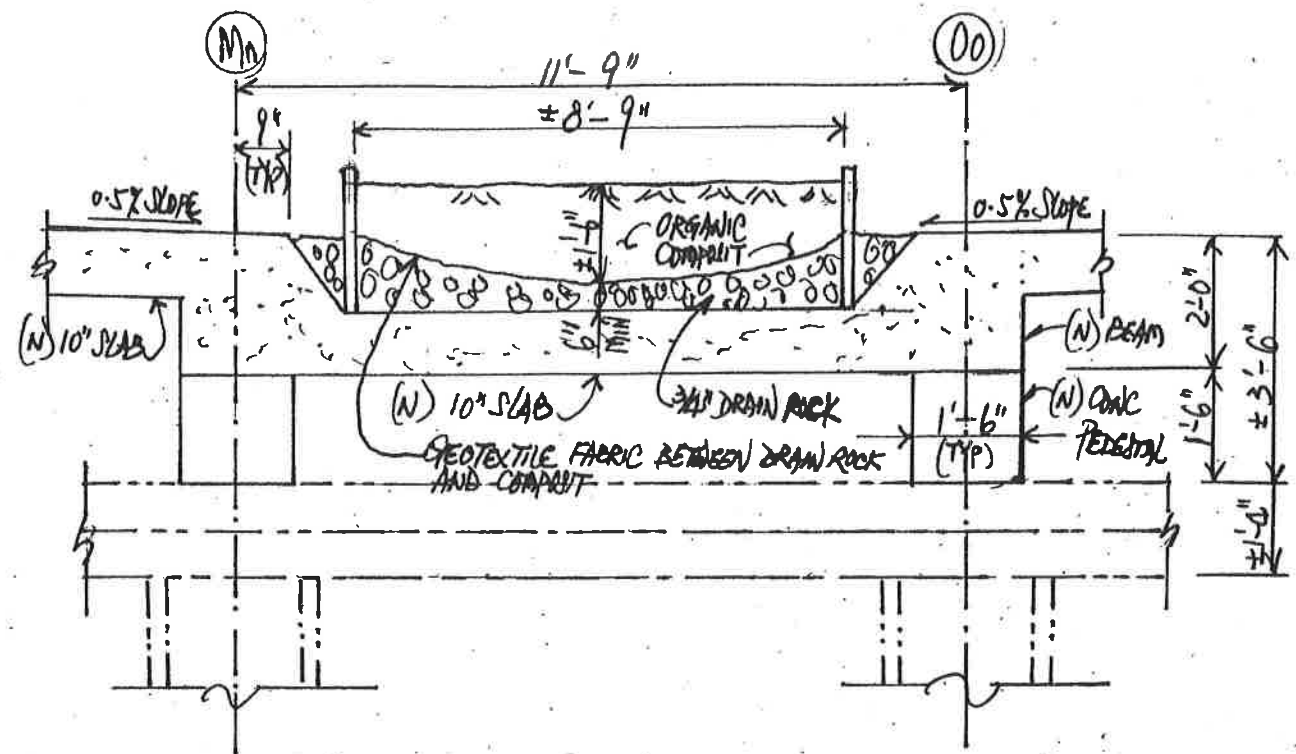


SECTION (LOOKING EAST) - BIOFILTRATION SWALE @ CENTER INFILL (1950 REGION)

OPTION I

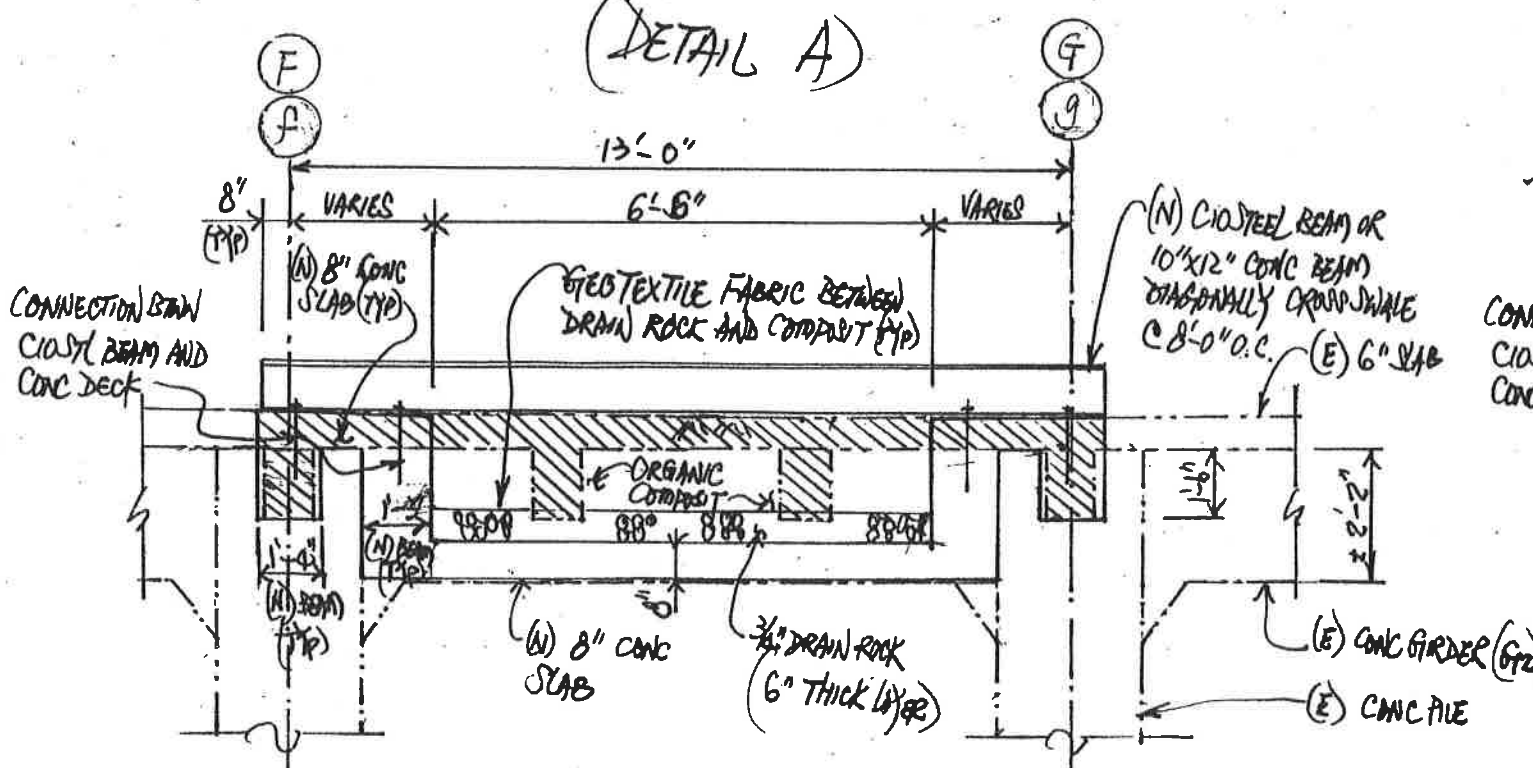
(DETAIL A)



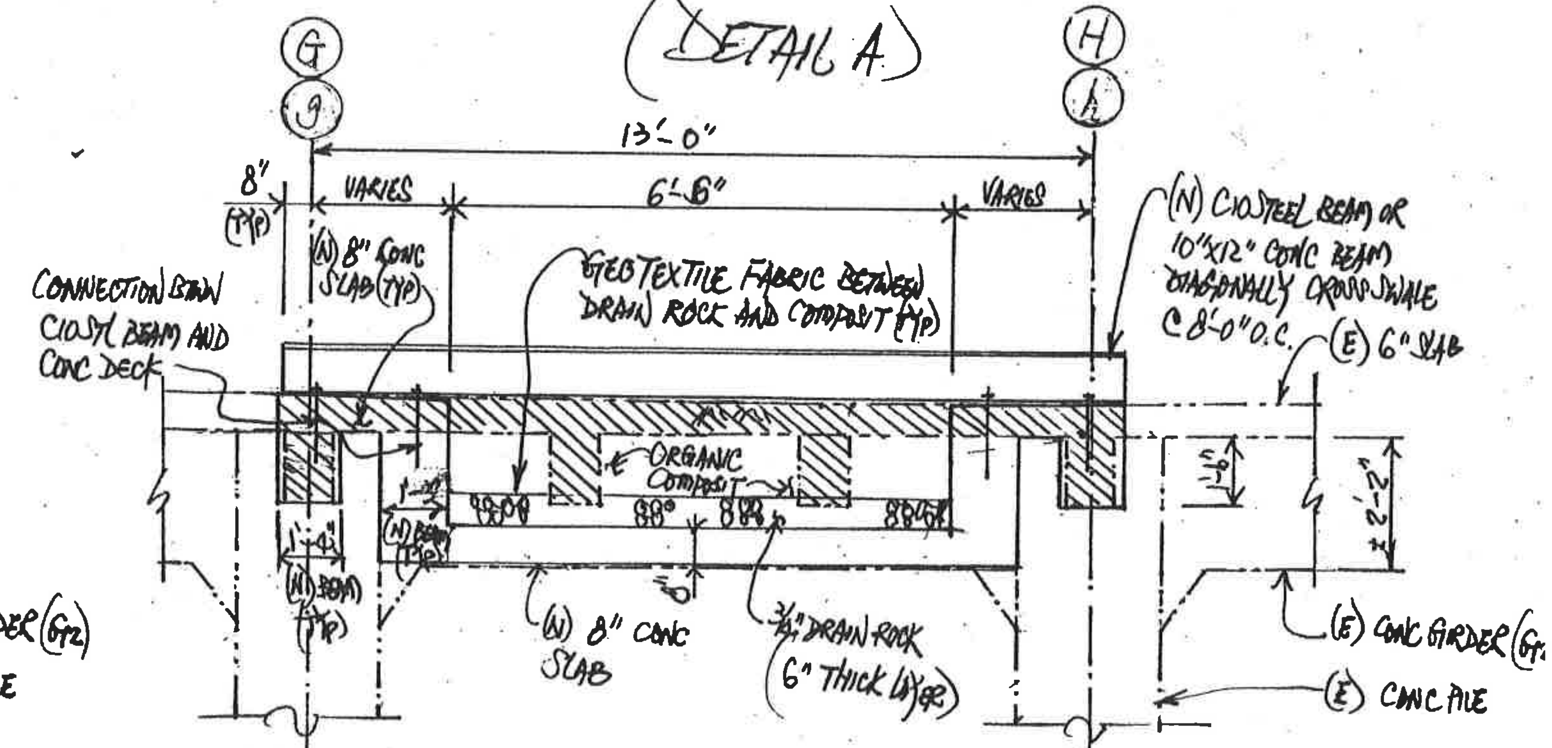
SECTION (LOOKING EAST) - BIOFILTRATION SWALE @ CENTER INFILL

OPTION II

(DETAIL A)



NOTE: REMOVE EXISTING SLAB AND BEAMS AS INDICATED IN [hatched] AREA AND REPLACE WITH NEW CONCRETE (CAST-IN-PLACE) SLAB AND BEAMS AS SHOWN.



NOTE: REMOVE EXISTING SLAB AND BEAMS AS INDICATED IN [hatched] AREA AND REPLACE WITH NEW CONCRETE (CAST-IN-PLACE) SLAB AND BEAMS AS SHOWN.

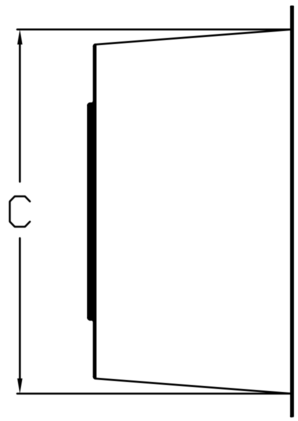
SECTION (LOOKING EAST) - BIOFILTRATION SWALES @ PIER 30 OR PIER 32

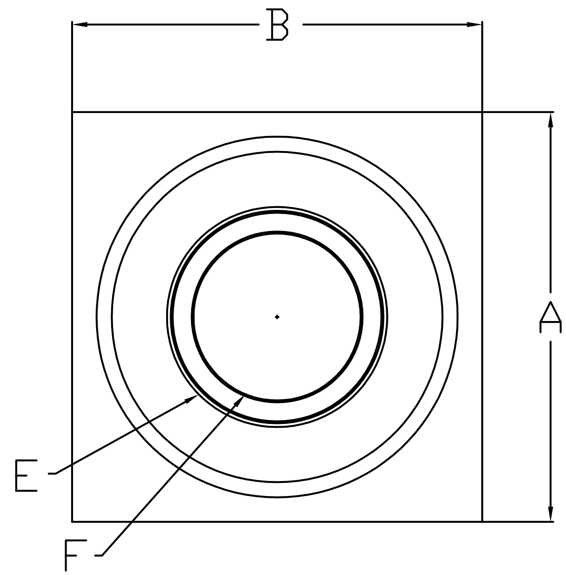
(DETAIL B)

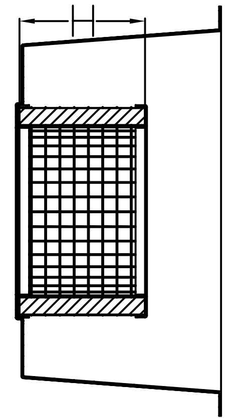
EXHIBIT 7

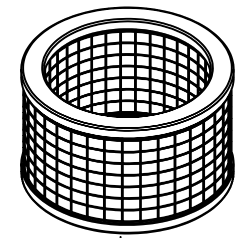
Media Filter Specifications

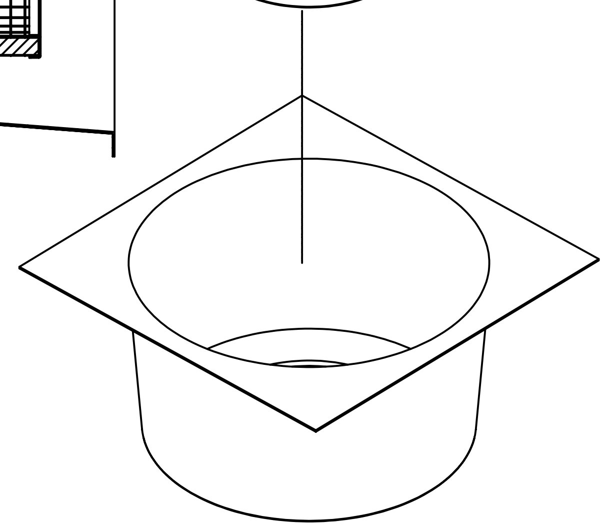
NOTES
1. ALL DIMENSION ARE IN INCHES UNLESS OTHERWISE NOTED
2. UNITS ARE CONTRUCTED FROM HIGH DENSITY POLYETHYLENE PLASTIC WITH UV INHIBITORS OR FIBERGLASS HAVING ISOPHTHALIC POLYESTER RESINS THAT ARE GEL COATED WITH ISO?NPG
3. MEDIA CARTRIDGES CAN BE INTERCHANGED WITH GEOTRAP SERIES AS SITE CONDITIONS CHANGE.
4. LOW PROFILE FILTER ARE ALSO AVAILABLE FOR SHALLOW CATCH BASINS.
5. CUSTOM SIZES ARE AVAILABLE TO FIT MOST APPLICATIONS. PLEASE CALL A LOCAL CONTECH OFFICE NEAR YOU FOR DETAILS.
6. OPTIONAL TRASH GUARD AVAILABLE.
7. DUAL STAGE AND DUAL CAPACITY FILTERS ALSO AVAILABLE FOR LARGER DEBRIS CAPACITIES
8. * DIMENSIONS 'A' AND 'B' SUPPORT FLANGES CAN BE ADJIUSTED TO SUITE VARYING SIZES OF CATCH BASINS
9. CUSTOM INSTALL BRACKETS ARE AVAILABLE AS NEEDED.

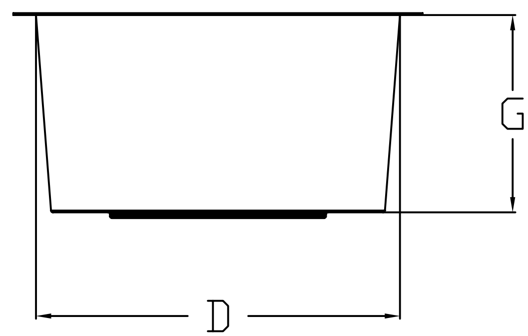












MODEL #	A*	B*	C	D	E	F	G	# CARTRIDGES	H	BASIN TYPE
TR1212	15.00	15.00	11.00	11.00	6.75	3.50	6.0	1 SHORT	4.5	HDPE
TR12RD	Ø15.00		Ø11.00		6.75	3.50	6.0	1 SHORT	4.5	HDPE
TR1616	20.00	20.00	14.00	14.00	6.75	3.50	10.5	1 STD	8.5	HDPE
TR16RD	Ø20.00		Ø11.00		6.75	3.50	6.0	1 SHORT	4.5	HDPE
TR1818	24.00	24.00	18.00	18.00	10.0	6.25	10.5	1 STD	8.5	HDPE
TR18RD	Ø24.00		Ø16.50		6.75	3.50	10.5	1 STD	8.5	HDPE
TR1824	19.00	25.00	18.00	18.00	10.0	6.25	10.5	1 STD	8.5	HDPE
TR2024	21.00	25.00	18.00	18.00	10.0	6.25	10.5	1 STD	8.5	HDPE
TR24SR	27.00	27.00	23.50	23.50	14.0	10.0	13.0	1 STD	8.5	HDPE
TR24RD	Ø28.00		Ø21.00		14.0	10.0	13.0	1 STD	8.5	HDPE
TR2436	32.00	40.00	22.00	29.00	14.0	10.0	21.0	1 TALL	16.5	HDPE
TR3030	34.00	34.00	22.00	29.00	14.0	10.0	21.0	1 TALL	16.5	HDPE
TR36SR	36.00	36.00	33.00	33.00	14.0	10.0	22.0	1 TALL	16.5	FIBRG
TR36RD	Ø36.00		Ø33.00		14.0	10.0	22.0	1 TALL	16.5	FIBRG
TR42RD	Ø42.00		Ø33.00		14.0	10.0	22.0	1 TALL	16.5	FIBRG
TR4848	48.00	48.00	42.00	42.00	24.0	19.75	22.0	1 TALL	17.5	FIBRG
TR48RD	Ø48.00		Ø33.00		14.0	10.0	22.0	1 TALL	16.5	FIBRG

REVISIONS	
REV	DESCRIPTION

TYPICAL DETAIL FOR DROP INLET STYLE TRITON CATCHBASIN INSERTS BY CONTECH

CONTECH® STORMWATER SOLUTIONS INC.
contechstormwater.com

SCALE: NONE
DRAWN: WSG
CHECKED: WSG
FILE NAME: TYPTBLTCBI
DATE: 8/12/09

APPENDIX 1

Bioretention Sizing Calculations

Triton Drop-In Model Specification

PART 1.00 GENERAL

1.1 DESCRIPTION

A. Work included:
The Contractor, and/or a manufacturer selected by the Contractor and approved by the Engineer, shall furnish all labor, materials, equipment and incidentals required and install all catch basin inserts in accordance with the drawings and these specifications.

B. The Triton Drop Inlet system is designed for use in stormdrains that experience oil and grease pollution accompanied by sediment, trash and debris. Trash, debris and sediment accumulate in the outer housing with oil and grease and fine particulates being trapped in the media cartridge. The system is a low cost best management practice (BMP) that helps meet National Pollutant Discharge Elimination System (NPDES) requirements with effective treatment, efficient installation and moderate maintenance.

1.2 QUALITY CONTROL INSPECTION

A. The quality of materials, the process of manufacture, and the finished sections shall be subject to inspection by the Engineer. Such inspection may be made at the place of manufacture, or on the work site after delivery, or at both places, and the sections shall be subject to rejection at any time if material conditions fail to meet any of the specification requirements, even though sample sections may have been accepted as satisfactory at the place of manufacture. Sections rejected after delivery to the site shall be marked for identification and shall be removed from the site at once. All sections that have been damaged beyond repair during delivery will be rejected and, if already installed, shall be repaired to the Engineer's acceptance level, if permitted, or removed and replaced, entirely at the Contractor's expense.

PART 2.00 PRODUCTS

2.1 MATERIALS AND DESIGN

A. Insert Trough/Housing

1. Inserts are available to fit most industry standard catch basins. Custom sizes are available to fit most applications.

2. Standard insert troughs or housings shall be constructed of non-reactive high density polyethylene (HDPE) plastic with U.V. inhibitors. Larger units requiring greater structural support shall be constructed using fiberglass with Isophthalic polyester resin, which provides corrosion resistance needed for wet applications.

B. Exterior Cartridge Cage

1. The exterior cage of the cartridges shall be made of stainless steel Type 304, having 0.063 gauge welded 1” square openings.

C. Media-Pak Cartridges

1. Disposable media-pak cartridges shall be constructed of durable geo-textile polyethylene fabric.

2. Media-pak cartridges shall be easily removed from housing for maintenance.

D. Media and Media-Pak Combinations

1. A number of combinations can be set in place to obtain the most appropriate treatment level for the site.
   <u>Option A – Standard:</u> Includes media-pak (a durable geotextile polypropylene fabric) charged with XSORB® media for capture of hydrocarbons, oils and grease and sediment.
   <u>Option B – Standard setup with cartridge pre-screen: I</u>ncludes exterior cartridge housing fitted with a woven polypropylene geo-textile that is designed to capture smaller sediment (e.g., 850 microns).
   <u>Option C – Dual stage media-pak charged with XSORB® media:</u> Includes two media-pak staggered within a cartridge cage designed to target heavy hydrocarbon runoff areas.
   <u>Option D – Dual stage media-pak with activated carbon</u>: A standard media-pak is fitted on the outer interior of the cartridge housing with a second media-pak (charged with activated carbon) fitted behind the standard media-pak. The second media-pak is designed as a polishing media to remove pollutants found in runoff.

2. The media shall be non-biodegradable and non-hazardous per the Environmental Protection Agency (EPA) and Occupational Safety and Health Administration (OSHA).

3. Media shall be a treated perlite having hydrophobic properties.

E. Diverter Panels

1. If required, diverter panels or flow block material shall be ultra violet resistant high density polyethylene.

2.2 PERFORMANCE

Each standard Triton Drop Inlet model shall adhere to the following performance specifications.

Drop Inlet Model No.	Flange Outside Dimension (OD)	Trash and Debris Capacity (ft^3)	Treatment Capacity[1] (gpm)	Bypass Capacity* (gpm)
TR12RD	13”	0.193	70	830
TR1212	13”X13”	0.193	70	830
TR 16RD	18”	0.673	142	1,660
TR1616	18”X18”	0.673	142	1,660
TR18RD	20”	0.936	151	1,660
TR1818	20”X20”	0.936	151	3,103
TR1824	19”X25”	0.936	157	3,103
TR2024	21”X25”	0.936	157	3,103
TR24RD	26”	1.070	299	4,261
TR24SR	26”X26”	1.070	299	4,261
TR2436	26”X40”	1.570	345	6,206
TR2448	26”X52”	2.140	572	8,522
TR3030	33”X33”	1.570	345	6,206
TR3636	40”X40”	8,430	690	12,412
TR36RD	40”	8.430	690	12,412
TR4848	52”X52”	15.500	1,196	17,044

* Bypass capacity is estimated as circular weir flow and is a function of the available head (inside top of structure to the overflow crest of the cartridge) and crest length. Typically, the bypass capacity should be less restrictive than the inlet grate of the catch basin.

[1] – Treatment capacity based on standard media-pak configuration (Option A).

2.3 MANUFACTURER

The manufacturer of said system shall have been regularly engaged in the engineering design and production of systems for the physical treatment of stormwater runoff for 10 years minimum. Each catch basin insert shall be supplied by CONTECH Stormwater Solutions Inc., 9025 Centre Pointe Drive, Suite 400, West Chester, OH 45069, phone 1-866-551-8325.

PART 3.00 EXECUTION

3.1 INSTALLATION

A. Each stormwater treatment system shall be constructed according to The dimensions shown on the Drawings and as specified herein. Install at elevations and locations shown on the Drawings or as otherwise directed by the Engineer.

B. If required in most cases, the housing flange can be cut in the field using a skill-saw or other saw blade to fit the grate frame.

WATER QUALITY VOLUME AND WATER QUALITY FLOW RATE CALCULATOR

This work sheet calculates the Water Quality Flow Rates or Water Quality Volumes for each drainage management area on your site.

Input cell =		User enters value
Default value =		User should only change value if able to provide explanation for adjustment
Calculation cell =		User should not change cell

CALCULATOR

Step 1	Total Site Area	199,130	square feet
Step 2	# of DMAs	1	

Step 3	Step 4	Step 5					Step 6	Step 7	Step 8									Step 9	Step 10
		Area Impervious (all in square feet)						Area Pervious (all in square feet)											
Drainage Management Areas	Drainage Management Area (square feet)	TOTAL	Standard Roof	Asphalt	Concrete	Brick/Pavers	Other	TOTAL	Permeable Pavement[a]	Vegetated Roof[b]	Gravel[c]	Landscaping	Grass Pavers/Turf Blocks	Lawns/grass, sandy soil, slope<2%	Lawns/grass, sandy soil, slope>7%	Lawns/grass, heavy soil, slope<2%	Lawns/grass, heavy soil, slope>7%	Other	Total Area Check
A 30/32	199130	199130			199130			0											Okay
B		0						0											Okay
C		0						0											Okay
D		0						0											Okay
E		0						0											Okay
F		0						0											Okay
G		0						0											Okay
H		0						0											Okay
I		0						0											Okay
J		0						0											Okay
Total	199130																		
Total Area Check	Okay																		
Number of DMAs Check	Okay																		

Impervious Runoff Coefficients		
Standard Roof	0.85	
Asphalt	0.8	
Concrete	0.9	
Brick/Pavers	0.75	
Other		Step 6

Pervious Runoff Coefficients		
Permeable Pavement [a]	NA	
Vegetated Roof [b]	NA	
Gravel [c]	0.25	
Landscaping	0.2	
Grass Pavers/Turf Blocks	0.35	
Lawns/grass, sandy soil, slope<2%	0.08	
Lawns/grass, sandy soil, slope>7%	0.17	
Lawns/grass, heavy soil, slope<2%	0.15	
Lawns/grass, heavy soil, slope>7%	0.3	
Other		Step 9

	Step 11
Drainage Management Area	Composite Runoff Coefficient
A 30/32	0.900
B 0	#DIV/0!
C 0	#DIV/0!
D 0	#DIV/0!
E 0	#DIV/0!
F 0	#DIV/0!
G 0	#DIV/0!
H 0	#DIV/0!
I 0	#DIV/0!
J 0	#DIV/0!

Chose Jurisdiction for WQv Performance Measure	1	Step 12
1. Port of San Francisco jurisdiction: 48 hour, 80% capture. Enter "1" in Step 12.		
2. SFPUC jurisdiction: 0.75 inch rainfall depth. Enter "2" in Step 12.		

WQf Performance Measure	
Design Rainfall Intensity (in/hr)	0.2

Note: For both the Port of San Francisco and the SFPUC, the WQf performance measure is based on a 0.2 in/hr rainfall intensity.

	Step 13	Step 14
Drainage Management Area	Water Quality Flow Rate cubic feet/sec	Water Quality Volume cubic feet
A 30/32	0.823	10995
B 0	#DIV/0!	#DIV/0!
C 0	#DIV/0!	#DIV/0!
D 0	#DIV/0!	#DIV/0!
E 0	#DIV/0!	#DIV/0!
F 0	#DIV/0!	#DIV/0!
G 0	#DIV/0!	#DIV/0!
H 0	#DIV/0!	#DIV/0!
I 0	#DIV/0!	#DIV/0!
J 0	#DIV/0!	#DIV/0!

Step 15								
DMA	Area	Drainage area constraints table						
	acres	BMP	min	max	BMP	min	max
A	4.57	Detention pond	5 ac*		Bioretention		1 ac **
B	0.00	Wet pond	5 ac		Media filter		5 ac
C	0.00	Dry well		0.25 ac	Water quality inlet		1 ac
D	0.00	Infiltration basin		10 ac	Vegetated rock filter	no contraints	
E	0.00	Infiltration trench		5 ac	Permeable pavement	no contraints	
F	0.00	Vegetated swale		5 ac	Swirl separator	no contraints	
G	0.00	Vegetated buffer strip		$2(A_{strip})$	Drain insert	no contraints	
H	0.00	Constructed wetland	5 ac		Vegetated roof	no contraints	
I	0.00	Detention vault		10 ac	Rainwater harvesting	no contraints	
J	0.00	* Or minimum orifice diameter of 1 inch			** Multiple cells can be used to treat larger areas		

November 2011 Version

INSTRUCTIONS

Step	
1	Enter the total square footage of your site. Areas are entered in units of square feet. Note: 1 acre = 43,560 square feet.
2	Divide your entire site into discrete drainage management areas (DMAs) and enter the number of DMAs. A DMA is a portion of your site that drains to a common location.
3	Name each DMA and enter one name per row in the cells adjacent to "A", "B", "C", etc.
4	Enter the square footage of each DMA.
5	Identify the different impervious land surfaces for each DMA and enter their square footage. If a permeable pavement area (i.e., pervious concrete, porous asphalt, or permeable paver) will receive run-on from adjacent surfaces, then the entire paved area (including the area planned for permeable pavement) should be entered as an impervious surface. The required size of the permeable pavement facility can then be calculated using the permeable pavement sizer.
6	Use the "other" column for impervious land surfaces not described. Enter the square footage of the "other surface" in the table. Below, in the Impervious Runoff Coefficients Table, enter a runoff coefficient, C, for the "other" impervious surface
7	Identify any existing permeable pavement or vegetated roofs on your site that are designed according to SDG requirements and do not receive runoff from adjacent surfaces. Enter their areas. See "Notes" section (a and b) at bottom of worksheet for additional description of permeable pavement and vegetated roofs.
8	Identify additional pervious land surfaces for each DMA and enter their areas. See "Notes" section (c) at bottom of worksheet for a description of whether to categorize gravel as permeable pavement or pervious area.
9	Use the "other" column, column T, for pervious land surfaces not described. Enter the square footage of the "other surface" in the table. Below, in the Pervious Runoff Coefficients Table, enter a runoff coefficient, C, for the "other" pervious surface .
10	Check column U is "okay". If not, adjust areas accordingly.
11	Composite runoff coefficients for each DMA are calculated and displayed here.
12	Choose jurisdication for performance measure. Projects in the Port of SF jurisdiction should select "1". Projects in SFPUC jurisdiction should select "2".
13	The Water Quality Flow Rate (WQf) for each DMA is calculated here. The WQf is the required flowrate to be managed by flow-based BMPs such that the water quality performance measure requirements are met.
14	The Water Quality Volume (WQv) for each DMA is calculated here. The WQv is the required volume to be managed by volume-based BMPs such that the water quality performance measure requirements are met.
15	Use DMA areas and drainage area constraints table to determine which BMPs are possible for which DMAs.

NEXT STEPS

Use the BMP sizing calculators to help you size and design each treatment control measure.
For flow-based measures, the treatment control measure must be sized such that it accommodates the Water Quality Flow Rate for each DMA.
For volume-based measures, the treatment control measure must be sized such that it accommodates the Water Quality Volume for each DMA.

NOTES

a Permeable pavement includes permeable pavers, porous asphalt, and pervious concrete designed according to SDG requirements. If runoff from adjacent impervious surfaces is draining to the permeable pavement, then the total paved area (including the area planned for permeable pavement) should be entered as impervious area in Step 5. The portion of this total paved area that must be converted to permeable pavement to meet the SDG treatment requirements can then be calculated using the Permeable Pavement calculator.

b Vegetated roofs should be designed in accordance with the SDG to capture the WQv from the roof DMA.

c Gravel surfaces can be considered a permeable pavement system if designed in accordance with the storage layer requirements outlined in the permeable pavement sizer and fact sheet. The gravel should be an open graded crushed washed AASHTO No. 8 stone or larger. The system should be designed to completely capture the WQv and either infiltrate it or detain it over a 48 hour period.

DEFINITIONS

Water Quality Volume Equation: $WQv = C \times A \times d/12$

Water Quality Flow Equation: $WQf = C \times i \times A/43560$

Where: WQf = water quality flow (cubic feet per second)
WQv = water quality volume (cubic feet)
C = runoff coefficient
i = design rainfall intensity (in/hr)
A = drainage area (square feet)
d = design depth of rainfall (inches)

Last updated: 11/23/10

BIORETENTION CALCULATOR

These calculators size the area of rain garden or flow-through planter to treat the Water Quality Volume (WQv), or calculate the volume of water treated given user entered available dimensions.
For sloped systems, use the volume-based Swale calculator.

Input cell =		User enters value
Default value =		User should only change value if able to provide explanation for adjustment
Calculation cell =		User should not change cell

Bioretention Calculator - by Available Area

13	Available Area	3000	square feet	
14	Site Meets Infiltration Constraints?	No		
15	Underlying Infiltration rate - f		inches/hour (generally require f ≥0.5"/hr)	
16	**Underdrains Required?**	**Yes**		
17	Depth of Bioretention Soil Mix - d	1.5	feet (generally 0.5 to 1)	
18	Porosity of Bioretention Soil Mix - n	0.35	recommend 0.35	
	Hydraulic Conductivity of Bioretention Soil Mix - k	5	in/hr (recommend 5)	
	Factor of Safety	2	recommend 2	
19	Max Ponding Depth above Filter - Pd	1	feet (recommend 0.5 to 1 ft)	
20	Fill Time - T	2	hours (0-2 hours, recommend 1)	
21	**Treated Volume**	**38500**	cubic feet	*
22	Area Draining to Bioretention	199,130	square feet	
23	Sizing Ratio (Bioretention Area/Drainage Area)	1.5%	typically between 4 to 7% of the impervious drainage area	**
24	Time Needed to Drain WQv	22	hours (if greater than 48 hours, install underdrains)	

* The actual volume treated is the volume of flow which will pond between the high points = 38,500 > 10,995 ft^3 CHECK
** The planters will be allowed to pond and thus serve a larger area than typical

DEFINITIONS

Water Quality Volume (WQv)	The runoff volume to be managed by the stormwater BMP such that treatment requirements are met. The WQv is calculated by the Water
Infiltration Rate (f)	The rate of water entry into the soil, generally expressed as inches/hour, and determined by geotechnical tests or estimated from soil
Porosity (n)	Volume of void space to total volume. This is expressed as a ratio, e.g. 0.35 means that one cubic foot of gravel contains 0.35 cubic feet
Fill Time (T)	The time taken for water quality storm to fill the bioretention system.
Ponding Depth (Pd)	The depth above the bioretention surface where runoff is ponded temporarily before filtering through the media.
Depth of Engineered Soil (d)	The depth of the engineered bioretention soil.
Hydraulic Conductivity (k)	Measure of the ease in which water moves through a porous media, generally expressed as inches/hour.
Drain Time (t)	The time for the storage area to drain the water quality volume.

APPENDIX 2

Detailed Cost Estimates

Bio retention Structure Weights/Cost

1.0 Pier 30/32 Bio retention 4 Locations ea	L	W	Th	V	Wt	Total	Unit Price	Cost
Concrete Beams	Excluded support from structure below				140 Lbs	- Lbs	$ 65.00 /cf	$ -
Concrete walls	162 Ft	3 Ft	1 Ft	486 cf	140 Lbs	68,040 Lbs	$ 65.00 /cf	$ 31,590
Concrete divide	69.5 Ft	1.65 Ft	1 Ft	115 cf	140 Lbs	16,055 Lbs	$ 65.00 /cf	$ 7,454
Bottom slab	69.5 Ft	6.5 Ft	0.75 Ft	339 cf	140 Lbs	47,434 Lbs	$ 65.00 /cf	$ 22,023
New Substructure Beams/Slab	165 Ft	6.5 Ft	1 Ft	1073 cf	140 Lbs	150,150 Lbs	$ 65.00 /cf	$ 69,713
Granular fill	69.5 Ft	6.5 Ft	0.5 Ft	226 cf	120 Lbs	27,105 Lbs	$ 5.00 /cf	$ 1,129
Organic compost	69.5 Ft	6.5 Ft	1.5 Ft	678 cf	100 Lbs	67,763 Lbs	$ 4.00 /cf	$ 2,711
Net Structure Removed	80 Ft	11.75 Ft	0.75 Ft	705 cf	140 Lbs	(98,700) Lbs	$ 40.00 /cf	$ 28,200
Other:								
Waterproofing	75 Ft	12 Ft		900 sf		100 Lbs	$ 8.00 /sf	$ 7,200
Filter fabric	80 Ft	12 Ft		960 sf		100 Lbs	$ 2.00 /sf	$ 1,920
Vegetation	80 Ft	12 Ft		960 sf		500 Lbs	$ 20.00 /sf	$ 19,200
Irrigation	80 Ft	12 Ft		960 sf		100 Lbs	$ 20.00 /sf	$ 19,200

Cost Ea	**278,646 Lbs**		**$ 210,339**
15% Cont.	41,797 Lbs		31,551
25% GC m/u			$ 60,472
10% Soft Cost			$ 30,236
Total Ea	**320,443 Lbs**		**$ 332,599**
x8	**2,563,540.90**		**$ 2,660,789**
4ea Pier 30			**$ 1,330,395**
4ea Pier 32			**$ 1,330,395**
Budget			**$ 2,660,789**
	298.78 #/sf		$ 248.09 $/sf

	L	W	Th	V	Wt	Total	Unit Price	Cost
Seismic Piles						3 ea	$ 250,000.00 /ea	$ 750,000

3.0 3000sf at Infill Bio retention No Seismic	L	W	Th	V	Wt	Total	Unit Price	Cost
Concrete Beams	Excluded support from structure below				140 Lbs	- Lbs	$ 65.00 /cf	$ -
Concrete walls	620 Ft	3 Ft	0.5 Ft	930 cf	140 Lbs	130,200 Lbs	$ 65.00 /cf	$ 60,450
Precast top	300 Ft	11.75 Ft	0.75 Ft	2644 cf	140 Lbs	370,125 Lbs	$ 85.00 /cf	$ 224,719
Bottom slab	300 Ft	10 Ft	0.75 Ft	2250 cf	140 Lbs	315,000 Lbs	$ 65.00 /cf	$ 146,250
Granular fill	300 Ft	10 Ft	0.5 Ft	1500 cf	120 Lbs	180,000 Lbs	$ 5.00 /cf	$ 7,500
Organic compost	300 Ft	10 Ft	1.5 Ft	4500 cf	100 Lbs	450,000 Lbs	$ 4.00 /cf	$ 18,000
Foam fill	300 Ft	10 Ft	1	3000 cf	2 Lbs	6,000 Lbs	$ 5.00 /cf	$ 15,000
Net Structure Removed	300 Ft	11.75 Ft	0.75 Ft	-2644 cf	140 Lbs	(370,125) Lbs	$ 40.00 /cf	$ (105,750)
Misc.								
Additional Interim media drains	N/A	N/A	N/A	N/A	N/A	20 ea	$ 3,500.00 /ea	$ 70,000
Waterproofing	300 Ft	12 Ft		3600 sf		720 Lbs	$ 6.00 /sf	$ 21,600
Filter fabric	300 Ft	16 Ft		4800 sf		960 Lbs	$ 2.00 /sf	$ 9,600
Vegetation	300 Ft	10 Ft		3000 sf		12,000 Lbs	$ 20.00 /sf	$ 60,000
Irrigation	300 Ft	10 Ft		3000 sf		2,000 Lbs	$ 20.00 /sf	$ 60,000

Total Cost	**1,096,900 Lbs**		**$ 587,369**
15% Cont.	164,535 Lbs		88,105
25% GC m/u			$ 168,869
10% Soft Cost			$ 84,434
Total	**1,261,435 Lbs**		**$ 928,777**
	148.55 #/sf		$ 309.59 $/sf

4.0 Media Filters Only 28 Ea.	L	W	Th	V	Wt	Total	Unit Price	Cost
Demo. Drains	N/A	N/A	N/A	N/A	N/A	28 ea	$ 750.00 /loc	$ 21,000
Support Drains	N/A	N/A	N/A	N/A	N/A	28 ea	$ 750.00 /loc	$ 21,000
Install Drain	N/A	N/A	N/A	N/A	N/A	28 ea	$ 1,500.00 /loc	$ 42,000
Grout Drain	N/A	N/A	N/A	N/A	N/A	28 ea	$ 150.00 /loc	$ 4,200

Total Cost			**$ 88,200**
15% Cont.			13,230
25% GC m/u			$ 25,358
10% Soft Cost			$ 12,679
Total			**$ 139,466**
			$ 4,980.94

Alternative 1	1 @ 3,000 SF planter infill area	$ 929,000	$ 4,364,000.00
	4 @ 487.5 SF planters Pier 30	$ 1,330,000	
	4 @ 487.5 SF planters Pier 32	$ 1,330,000	
	3 @ seismic piles	$ 750,000	
	5 @ media filter	$ 25,000	
Alternative 2	1 @ 3,000 SF planter infill area	$ 929,000	$ 1,014,000
	17 @ $3,500 media filter	$ 85,000	
Alternative 3	28 @ $3,150 media filter	$ 139,000	$ 139,000
Alternative 4	1 @ 3,000 SF planter infill area	$ 929,000	$ 929,000